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Swiss Federal Research Institute WSL

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The Queen of the Alps – the Swiss Stone Pine

The five-needled Swiss stone pine is perfectly suited to harsh mountain climates where it braves wind and weather its whole life long. It also has a symbiotic relationship with the nutcracker which disperses its seeds year after year.

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Who doesn't love the typical smell of a room panelled out in Swiss stone pine? The characteristic smell probably comes from essential oils within the wood, but this has never been looked into. However, what has been proven is the effect the smell has on people: spending a night in a room panelled out with Swiss stone pine wood lowers the heart rate and induces a deeper sleep. If such a room is not available pillows filled with aromatic Swiss stone pine shavings are available which also produce the same effect.

Swiss stone pine wood is light and easy to work and has therefore always been an ideal material for furniture making, for decorative wall panelling and for every-day objects such as milk pails. Swiss stone pine wood was also used as firewood, which is why Swiss stone pine stands were extensively exploited.

The fact that many areas still exist in the Swiss Alps where Swiss stone pines grow is not only due to a re-thinking about the use of timber, but also to the resilience of this species.

The majority of Swiss stone pines are to be found in sub-alpine continental areas at an elevation of 1300 to 2500 m. In the Stazerforest near St. Moritz (GR) Swiss stone pines thrive everywhere on the acidic soil. Photo: Sabine Brodbeck (WSL)

A weather tree marked by life

In 1935 A.L. Schnidrig wrote the following in a magazine about the Alps: "*A pine forest is a*

mountain's ornament, adorning its bald skull with curls of frankincense." The fascination of this charismatic mountain tree species is still unbroken today and thanks to modern research we know much more about its unique and ingenious way of life.

In the course of their lives, which is often several hundred years long, Swiss stone pines undergo many trials. They can tolerate temperatures ranging from –40 to +40 °C. This endurance makes this species one of the native trees most adapted to harsh mountain conditions. That is why in the mountains they form the uppermost edges of the forest where other tree species are not able to exist. Usually the Swiss stone pine grows together with larches, Alpine roses and blueberries. In contrast to larches as pioneer tree species, Swiss stone pines only colonise areas when the soil provides an adequate acid raw humus layer.

The Swiss stone pine is easily recognised as it is the only coniferous species in the sub-alpine forests with five needles per tuft. Individual trees can reach a height of 25 meters and a trunk diameter of 1,7 meters. This makes trunks susceptible to the weather. As their wood is rather brittle top breaks caused by snow, lightening, storms or avalanches are quite frequent. However, lateral shoots often re-sprout resulting in imposing "weather trees". In view of its tenacity A.L. Schnidrig wrote the following: "*Here and there stands a loyal warrior at his post, his shaft smashed; his arm stretched out from the boulders like a battle axe seeking to do battle; or crouching like an old man who the storm of life has bent over his crutches.*"

The red male flowers produce pollen which is dispersed by the wind. Photo: Sabine Brodbeck (WSL)

At first the female flowers resemble small red cones. They develop into full cones the following year. Photo: Kurt Bollmann (WSL)

Swiss stone pine seeds supplement the menu

The Swiss stone pine flowers after about 60 years. These flowers are formed in the upper third of the crown and are hardly visible to humans. The male and female flowers are optimally placed for the wind, which takes care of pollen dispersal. Only in the following year do the female inflorescences grow into three to eight centimetre long cones in which

the seeds ripen. There are up to 150 seeds per cone, each weighing around a quarter of a gram. The seeds are enclosed in a hard shell.

The soft inside, which resembles ordinary pine seeds, is nutritious and tasty. In early times these seeds were a welcome contribution to the menu plan, even though they were time-consuming to collect. They were also a valuable export product. This fact has left its mark: Swiss stone pine cones are called "Betschla" in the Engadine, from which the family name Bezzola is deduced. And originally the famous Engadine nut pie was supposedly made from Swiss stone pine seeds instead of the walnuts used today.

Cohabitation with the nutcracker

Swiss stone pine seeds are not only a welcome source of food for humans, but even more so for nutcrackers. Since Swiss stone pine seeds are heavy and do not have any means of flight they rely on dispersal by animals, especially the nutcracker. This is generally why intact Swiss stone pine cones are rarely seen.

The majority of ripe cones do not fall off the trees but are collected by nutcrackers and taken to so called "cone anvils". These are tree trunks or forks in trees where the cones are clamped in, similar to a workbench, and are worked open by the nutcracker's strong beaks. The shells are either opened and the seeds eaten straight away or they are stored unopened. Suitable hiding places are: tree trunks; large stones; boulders; terrain edges and these may be far beyond the tree line.

In the centre of the picture - a nutcracker's cache with Swiss stone pine seeds (open for photo purposes). Photo: Kurt Bollmann (WSL)

Such sites do not have a thick covering of snow in winter and can be found again quite easily by the nutcracker. The hiding places are about 2 cm deep in the surface litter. Whilst transporting up to 100 seeds in its throat pouch the nutcracker can cover distances of up to 15 kilometres and 600 altitudinal metres.

Per season a nutcracker establishes around 10'000 caches each with up to 10 nuts. The hidden seeds are of top quality, as the birds sort out all bad-quality seeds. The nutcracker later finds around 80% of its hiding places, even in winter under snow cover. However, the caches which are not rediscovered are not lost; in fact they are vital for the survival of the Swiss stone pine because the places chosen by the nutcracker also provide ideal conditions for the germination of the seeds.

The nutcracker likes to feed on Swiss stone pine seeds, which it also stores. In winter it digs down into the snow, up to 130cm, to get to its stored seeds. Photo: [kuhnm](#), Wikimedia, Creative Commons Licence

Therefore, the nutcracker supports the natural rejuvenation of the Swiss stone pine in the mountain forests and thanks to the distance it covers the trees are spread beyond the current range of the Swiss stone pine. On mountain hikes such nutcracker sowings can be seen in the form of groups of juvenile Swiss stone pine trees. In case the nutcracker does eat all of its stores, then the Swiss stone pine is also equipped to deal with this situation. Every four to five years there is a mast year which produces so many cones that it would be impossible for all of the seeds to be eaten.

Inseparable: the Swiss stone pine and the nutcracker

The [nutcracker](#) (*Nucifraga caryocatactes*), along with jays, alpine choughs and magpies, belongs to the corvid family. A fully grown nutcracker is around 30 centimetres in length and weighs up to 200 grams. It lives in the Alps at altitudes of 700 to 2200 meters, but can also be found in the Jura. Its rasping call of “traa- traa- traa” gives its presence away. The breeding season lasts from the middle of March to the end of July. The nutcracker and its offspring feed mainly off Swiss stone pine seeds, or in areas where there are no Swiss stone pines, off hazelnuts and other forest fruits. After bringing up its young the nutcracker is fully occupied from morning till night collecting supplies for the rest of the year.

In earlier times the birds fell into disrepute due to their intensive seed collection. It was hunted into the 1960's. At first because it was in direct competition with humans for food, and later because it was believed that its huge appetite hindered the natural rejuvenation of the Swiss stone pine. The nutcracker was nearly extinct when various research projects were able to prove how important its seed collection is, especially for the natural rejuvenation of this tree species. The nutcracker is now protected.

Multi-trunk trees

On closer observation it can be seen that many fully-grown Swiss stone pines have multiple stems. Either they have grown together or the trunk divides at the base. The actual reason for this is the germination of the many seeds in a nutcracker's cache, which grow together as young trees.

How many individuals actually make up one "tree" can only be clearly answered by genetic testing. Needles are collected from the individual trunks and the genetic material (DNA) is isolated. Then using methods similar to those used in criminalistics or paternity analysis the number of actual individuals can be established thanks to genetic fingerprinting. Genetic tests carried out by the Federal Research Institute (WSL) on the Rautialp in the Canton of Glarus showed that many of the multi-trunk trees are actually made up of several individual trees.

Swiss stone pines with multiple trunks are often made up of different individuals. This can be detected by using genetic analysis Photo: Sabine Brodbeck (WSL)

Traces of the past on maps

The Swiss stone pine is endemic to the Alps and the Carpathian mountains. During the last ice age they were pushed out of Alpine regions probably only surviving on the south eastern edge of the Alps. From here they gradually re-settled the Alpine region and achieved their largest spread around 7,000 years ago. They then retreated into higher altitudes due to global warming and also because they were being forced out by a new arrival, the Norway spruce. Around 800 years ago the clearing of large alpine areas for use

as alpine pastures and an increase in the use of timber affected Swiss stone pine stands. It was not only the Swiss stone pine which suffered at this time, but all forest stands. Only with the introduction of the Forestry Act of 1876 was the clearing stopped. Due to a lack of resources in mountain areas the utilisation of forest meadows and litter restricted the rejuvenation of Swiss stone pines into the 20th century.

This eventful history also left traces on maps: at least 76 mountain, field and place names are derived from the word "Arve" (Swiss stone pine), e.g. Arvengarten, Arbenhorn and of course Arolla. That this tree species was much more common and much more widespread in earlier times can also be seen from the name Arvenbühl near Amden, where the tree giving the place its name no longer exists.

Today areas with Swiss stone pines stretch from Valais to Engadine, whereby they are mainly found in the inner alpine dry valleys which are subject to extreme temperature changes. But at times they are also to be found along the edge of the Alps, for instance in the regions of Glarus and Sargans, the Bernese Oberland, Vaud and the mountains of the Ticino. However, these are usually small, isolated stands. New research shows that these stands in particular are facing an uncertain future.

A typical Swiss stone pine forest in the northern Alps on the Rautialp above Näfels (GL): in contrast to the main distribution area, Swiss stone pine grows on calcareous ground only on elevated sites, where the soil is sufficiently acidic. Photo: Sabine Brodbeck (WSL)

Climate change a threat?

Genetic testing carried out by the WSL has shown that the Swiss stone pine has lost some of its genetic diversity on its journey from the eastern to the western Alps. The long-term decline in the occurrence of the Swiss stone pine has also contributed to this loss of genetic diversity. This alone does not mean that isolated stands are faring badly, but experiments have shown that the success of seed germination of small stands is low, which could turn out to be a long-term problem for the survival of such stands.

These findings point out that the long-term survival of Swiss stone pines is not to be taken for granted. More problems could also be brought about by changes in climate. Heavier rainfall combined with higher temperatures affect young plants, because under such conditions damage caused by snow mould and other fungal diseases increases.

Writing about what the disappearance of the Swiss stone pine from the Alps would mean, A.L. Schnidrig wrote: *"The wanderer's thirst for the wind rushing through the tops of the frankincense filled (Swiss stone) pine forests would remain unquenched and too late would be the nature lover's regretful declaration: what a shame about the pine forests, the adornment of our mountains."* The Swiss stone pine has recovered from its former over-exploitation, and the state of stands is much better than in 1935. However, the future existence of Swiss stone pines is not safeguarded, especially along the edge of the Alps.

Individual Swiss stone pines above the tree line near Foppe di Pönt on the Lukmanier pass.
Could this be heralding the ascent of the tree line? Photo: Josef Senn (WSL)

Translation: Dawn Meister (Affoltern a. A.)

More on waldwissen.net

Jewel in the crown: the mountain pine forest

Typical of the mires in Bavaria, but globally a rarity: the mountain pine. Given that this species only exists here, we have a special responsibility to protect *Pinus rotundata*.

20.07.2018

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The Scots Pine – Tree of the year 2007

The Scot's pine is known in German speaking countries by several different names. The "resin tree" or "pitch tree" are just two names that are reminiscent of past uses.

14.01.2008

♥ 3.1 💬 0 📌

More from the Web

- [Distribution of Swiss stone pine in Europe \(euforgen.org\)](http://euforgen.org)
- [Photos of Pinus cembra in Switzerland \(pinetum.org\)](http://pinetum.org)
- [Swiss Stone Pine Fact Sheet \(treetopics.com\)](http://treetopics.com)

Document infos

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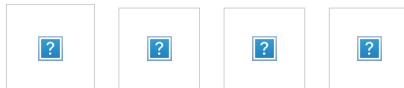
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